

5 What is claimed is:

1. A digital filter for filtering sample data, comprising:  
a delay network for delaying input sample data to provide a plurality of  
delayed sample data outputs;

10 a filter network representable by a decomposed coefficient weighting  
matrix for processing said delayed sample data outputs; and

a processor for producing a filtered output by computing a weighted  
product summation of said delayed sample data outputs and said coefficient weighting  
matrix.

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2. A digital filter according to claim 1, wherein  
said decomposed coefficient weighting matrix comprises a structurally  
factored matrix.

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3. A digital filter according to claim 2, wherein  
said structurally factored matrix employs a factor derived based on a  
property including at least one of, (a) coefficient matrix row symmetry, and (b)  
coefficient matrix column symmetry.

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4. A digital filter according to claim 1, wherein  
said decomposed coefficient weighting matrix is derived by at least one  
of (a) factoring a first coefficient weighting matrix with a common row factor, and (b)  
factoring a first coefficient weighting matrix based on at least one of, (i) coefficient  
matrix row symmetry, and (ii) coefficient matrix column symmetry.

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5. A digital filter according to claim 1, wherein  
said decomposed coefficient weighting matrix is derived by factoring a  
first coefficient weighting matrix using a sparse matrix.

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6. A digital filter according to claim 1, wherein  
said decomposed coefficient weighting matrix represents a multiple  
input, multiple output, filter network.

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7. A digital filter according to claim 1, including  
an interpolation network for interpolating sample data to provide said  
input sample data.

5 8. A digital filter according to claim 1, wherein  
said processor is responsive to a sample spatial position index signal in  
producing said filtered output.

10 9. A digital filter according to claim 1, wherein  
said processor includes a factor combiner for deriving a weighted sum  
of factors representing a linear transform process.

10. A digital filter according to claim 1, wherein  
said decomposed coefficient weighting matrix exhibits the form

$$\begin{bmatrix} 0 & 0 & 3 & 0 \\ -1 & 4 & -2 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

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11. A digital filter according to claim 1, wherein  
said digital filter provides the function

$$H(z) = \begin{bmatrix} 1 & \mu & \mu^2 \end{bmatrix} \cdot \begin{bmatrix} 0 & 0 & 3 & 0 \\ -1 & 4 & -2 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ z^{-1} \\ z^{-2} \\ z^{-3} \end{bmatrix}$$

20 where  $u$  is a sample spatial position representative signal and  $z$  represents an input  
sample.

12. A digital filter according to claim 1, wherein  
said decomposed coefficient weighting matrix exhibits the form

$$\begin{bmatrix} 6 & 58 & 58 & 6 \\ 23 & 59 & -59 & -23 \\ 31 & -31 & -31 & 31 \\ 16 & -48 & 48 & -16 \end{bmatrix}$$

128

- 5 13. A digital filter according to claim 1, wherein  
said digital filter provides the following function, where  $u$  is a sample  
spatial position representative signal and  $z$  represents an input sample

$$H(z) = \begin{bmatrix} 1 & \mu & \mu^2 & \mu^3 \end{bmatrix} \begin{bmatrix} \frac{1}{2} & 0 & \frac{3}{64} & 0 \\ 0 & 1 & 0 & \frac{23}{128} \\ 0 & 0 & \frac{31}{128} & 0 \\ 0 & 0 & 0 & \frac{1}{8} \end{bmatrix} \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 1 & -1 & 0 \\ 1 & -1 & -1 & 1 \\ 1 & -3 & 3 & -1 \end{bmatrix} \begin{bmatrix} 1 \\ z^{-1} \\ z^{-2} \\ z^{-3} \end{bmatrix}$$

- 10 14. A method for filtering sample data, comprising the steps of:  
delaying input sample data to provide a plurality of delayed sample data  
outputs;

processing said delayed sample data outputs using a filter network  
represented by a structurally factored coefficient weighting matrix; and

- 15 producing a filtered output by computing a weighted product  
summation of said delayed sample data outputs and said coefficient weighting matrix.

- 15 15. A method according to claim 14, wherein  
said structurally factored matrix comprises a coefficient weighting  
20 matrix employing factors derived based on a property including at least one of, (a)  
coefficient matrix row symmetry, and (b) coefficient matrix column symmetry.

16. A method according to claim 14, wherein  
said structurally factored matrix is derived by at least one of (a)  
25 factoring a first coefficient weighting matrix with a common row factor, and (b)  
factoring a first coefficient weighting matrix based on a property including at least one  
of, (i) coefficient matrix row symmetry, and (ii) coefficient matrix column symmetry.

17. A method according to claim 14, wherein  
30 said structurally factored matrix comprises a decomposed coefficient  
weighting matrix derived by factoring a first coefficient weighting matrix using a  
sparse matrix.

5 18. A method for filtering sample data, comprising the steps of:  
 delaying input sample data to provide a plurality of delayed sample data  
 outputs;

processing said delayed sample data outputs using a filter network  
 using a coefficient weighting matrix comprising,

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$$\begin{bmatrix} 0 & 0 & 3 & 0 \\ -1 & 4 & -2 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}; \text{ and}$$

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producing a filtered output by computing a weighted product  
 summation of said delayed sample data outputs and said coefficient weighting matrix.

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19. A method for filtering sample data, comprising the steps of:  
 delaying input sample data to provide a plurality of delayed sample data  
 outputs;

processing said delayed sample data outputs using a filter network  
 using a coefficient weighting matrix comprising,

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$$\begin{bmatrix} 6 & 58 & 58 & 6 \\ 23 & 59 & -59 & -23 \\ 31 & -31 & -31 & 31 \\ 16 & -48 & 48 & -16 \end{bmatrix}; \text{ and}$$

128

producing a filtered output by computing a weighted product  
 summation of said delayed sample data outputs and said coefficient weighting matrix.